MONTGOMERY COUNTY SAND FILTER (MCSF)

Revised December 19, 2002

A. Facility Description

Montgomery County DPS staff have developed a simple surface sand filtration system for providing water quality control which is preferred for drainage areas of 10 acres or less. The Montgomery County Sand Filter (MCSF) is essentially a shallow, dry stormwater management facility which incorporates a sand filter with an underdrain in its bottom. The MCSF system does not employ a pre-treatment sediment basin. Instead, pretreated runoff is conveyed directly to the facility. Pretreatment may be provided prior to entry into the facility, or in the bottom of the facility.

B. Design Considerations

1. Applicability

The MCSF may be considered for catchment areas up to 10 acres, except as noted below. For catchments over 10 acres in size or where high particulate pollutant loads and/or trash-debris levels are expected, multiple BMP's, and/or increased pretreatment must be used. In Special Protection Areas, the maximum catchment area is 5 acres. The MCSF must be located a minimum of 20-feet from any building foundation, as measured from the 10-year water surface elevation within the facility. It may not be located in the bottom of a detention pond unless the total drainage area to the facility is $\leq$ 2 acres.

2. Design Storm

The facility must be sized to provide storage for the required water quality volume. Peak flows from the 10-year frequency storm must be safely conveyed around the facility whenever possible.

3. Groundwater

In general, the MCSF system should not be located where its construction will expose and release groundwater. In situations where groundwater is encountered, additional design requirements may be necessary.

C. Specifications and Details

1. Embankment Criteria

These criteria are for shallow facilities only. For MD-378 pond facilities, those criteria and DPS pond requirements must apply.

As shown in Figure 11, the MCSF utilizes an embankment with a minimum top width of four feet, maximum 3:1 side slopes and a core trench. Appropriate pond construction specifications must also be used. It is imperative that the appropriate underdrain excavation, core trench, and all backfill and embankment requirements are met, since these are permanent facilities. Refer to "Construction Specifications for Shallow Facilities". For facilities that meet the pond standard as defined in MD-378, those criteria and DPS pond requirements must fully apply. However, the sand and underdrain criteria described herein must be utilized.

2. Overflow Weir Sizing Criteria

Design of the overflow weir, if required, is largely dependent upon the way flows are delivered to the facility. Refer to "Montgomery County Flow Splitting Criteria". Generally, the overflow weir design is as follows:

a. An overflow weir may not be required where a minimum of one foot of freeboard is provided above the 10-year water surface elevation in the facility.

b. If an overflow weir is necessary, it can be similar to a small emergency spillway and must be located at existing ground level or in cut. If the facility is not fed by a flow-splitter, size the weir to safely pass the full 10-year storm.

   If the facility is fed by a flow-splitter, outlet weir sizes may be reduced, with the outlet weir sized to safely pass whatever portion of the 10-year storm is delivered to the facility. In this case, protection may be provided by a permanent turf reinforcement matting rather than rip rap. Utilization of turf reinforcement matting should be considered wherever stream thermal concerns are an issue.

   Individualized designs to safely pass either a flow-split Q or the 10-year storm, both with one foot of freeboard, are necessary. Provide a safe non-erosive outlet below the outfall.

3. Drawdown Time

To allow the facility to be free to treat consecutive storms, while increasing the treatment time to provide for additional pollutant removal, a perforated underdrain cap is used. The cap must be removable, and must be perforated with seven 3/8-inch holes.

4. Water Quality Storage Criteria

Storage volume is determined from the top of the sand to the crest of the outlet weir (if provided) or invert of the flow splitter overflow pipe, whichever is lower. Storage within the sand/gravel layers shall not be considered toward required storage volume.

5. Sand Filter Layer

Washed ASTM C33 Fine Aggregate Concrete Sand is utilized for applications in Montgomery County. DPS requires a minimum sand depth of 18 inches above the underdrain gravel. **Manufactured sand or stone dust is not acceptable.**

Minimum filter area is determined by multiplying the WQV by 10%, with a minimum surface area of 200 square feet. For example, if the WQV is 3,500 cubic feet, the required sand filter surface area is 350 square feet, as illustrated by the formula below:

$$A_f = WQV\ (0.1)$$

If WQV (0.1) < 200, use 200 square feet as the minimum surface area.

For treatment areas with no impervious drainage area, such as golf courses and playing fields, the minimum filter area shall be determined exactly as above, with the exception being that the minimum filter surface area is 100 square feet.

If the storage amount provided is in excess of the required WQV, the surface area will be computed based on the provided volume.

A 4-inch layer of washed pea gravel must be placed on top of the sand layer. The gravel must be washed, uncrushed natural pea gravel, size no. 8. The top of the gravel must be level with the surrounding ground surface. No geotextile or filter fabric will be allowed between the pea gravel and the sand.

6. Gravel Bed Around Collector Pipe(s)

The gravel layer surrounding the underdrain pipe(s) must meet MSHA size #7 (Table 901A), and must provide a minimum of 6 inches cover over the pipe(s). No geotextile or filter fabric is allowed anywhere within the filter media (stone and sand). The gravel must extend across the entire bottom of the facility, with a minimum of 3-inches below the perforated underdrain pipe.

7. Underdrain Pipe

The underdrain pipe consists of 6-inch diameter schedule 40 or stronger perforated PVC pipe at 0.00% slope. Perforations must be 3/8 inch in diameter and must be located 4 inches on center, every 90 degrees around the pipe. Perforated pipe must begin at least 5' inside the filter media.

Access for cleaning all underdrain piping is needed. Clean-outs for each pipe should extend 6 inches above the top of the sand and have a removable waterproof cap.

The required number of underdrain pipes is proportional to the surface area of the sand filter. To determine the number of underdrain pipes, multiply the surface area square footage by 0.05. This determines the linear feet of piping required. Use a minimum of two pipes whenever possible. For example, if the surface area of the sand filter is 450 square feet, then:

450 (0.05) = 22.5 LF (This should be rounded to the nearest foot.)

Thus, the requirement will be for two underdrain pipes, each 11 feet long.
Underdrain pipes should be placed a minimum of 5' apart.

8. Pre-Treatment Grass Filter

As previously stated, stormwater runoff entering the MCSF system must outfall onto a rip-rap or surge stone apron which discharges into a grass filter strip or swale. For entry points conveying runoff from less than 2 acres of vehicular imperviousness, the required grass filter length shall be determined by multiplying the sand filter surface area by 0.1. In no case shall the grass filter strip be less than 20 LF. For example, if the surface area of the sand filter is 450 square feet, then:

450 (0.1) = 45 LF grass pre-treatment required

For entry points conveying runoff from more than 2 acres of vehicular imperviousness, some form of structural pre-treatment device will be required.

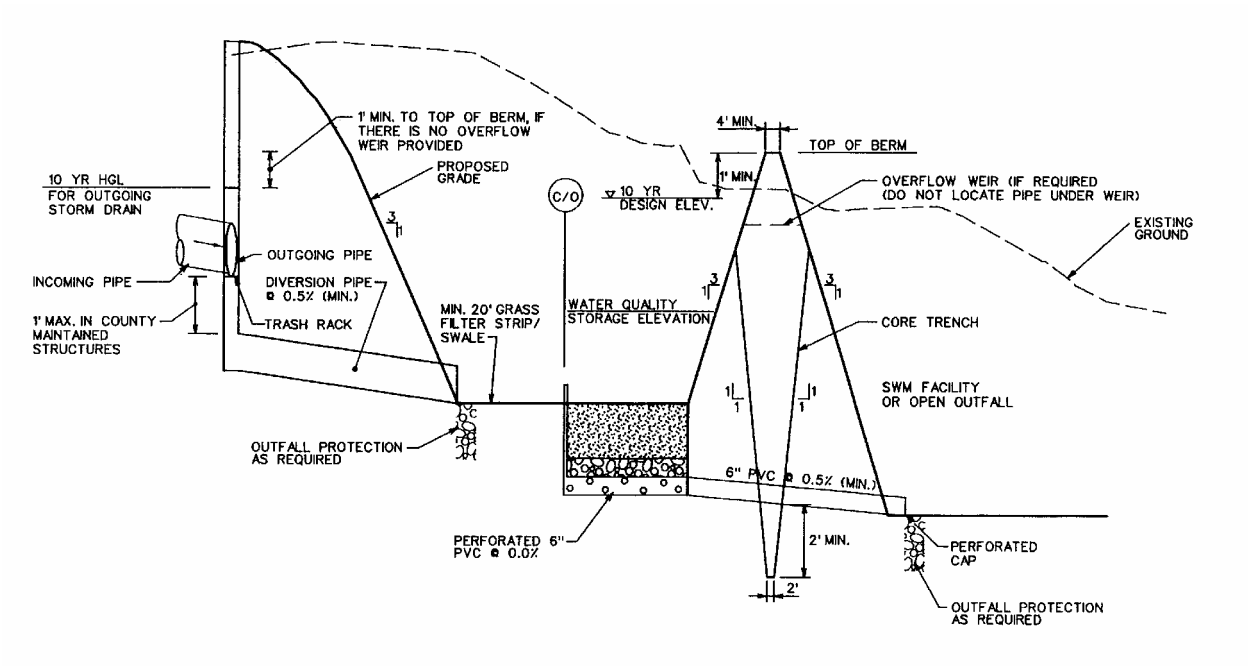
All incoming runoff shall be treated in this manner prior to its entry onto the sand surface layer. A typical location for the pre-treatment grass filter strip or swale is along the back portion of the facility, adjacent to the sand. In subdivisions with open section roadways, the road ditches may be considered as pretreatment.

9. Internal Basin Geometry

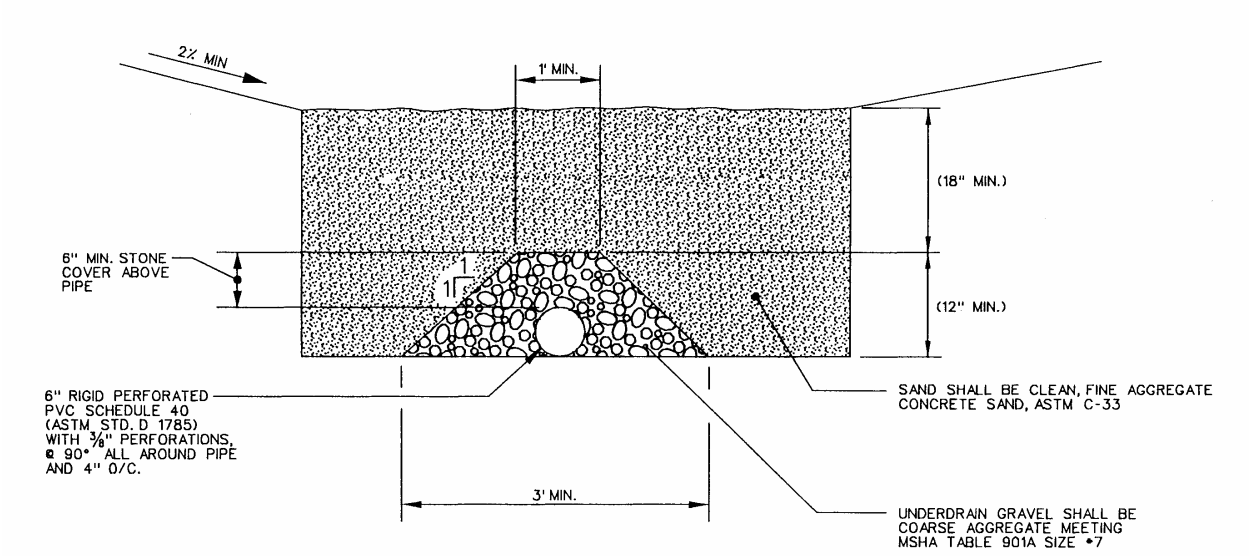
Inflow points and the underdrain pipe(s) should be located as far away from one another as possible to maximize the length of the pollutant removal pathway. Within the grass swale system, low height earthen berms can be employed to increase the pollutant removal pathway.

10. Outfall Protection

Any pipe outfall from a MCSF must be onto a rip-rap or surge stone apron. A concrete endwall is required for pipe support.



Typical Profile - Montgomery County Sand Filter



Typical Section – Montgomery County Sand Filter

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